Write your name on the cover of the test booklet and nowhere else. Enclose this sheet with the booklet. Failure to follow these directions will cost you 1 point. The test has 100 points (to be scaled up to 250 points) and is scheduled to take 50 minutes. Therefore, expect to spend 1 minute for every 2 points. For example, a 12-point question should take 6 minutes. I cannot give extra time because some students have a class after your class.

Show all work on all questions.

1) (14 points) Answer EITHER Part A OR Part B.
A) Is the utility function for music and food, $U(F, M) = F^{1/2} + M^{1/2}$, a valid utility function? Do all tests and state each tests' results.
B) Find all Nash equilibria in the payoff matrix on the back. Prove that you found all and prove they are Nash equilibria. Does either firm have a dominant strategy? Explain your logic. Find the cooperative equilibrium. Explain how you found it. What are the two players' secure strategies? How did you find them? You **can** write on the matrix itself without copying it into the test booklet.

2) (18 points) Maximize your utility from food, and clothing if your utility function is given by $U(C, F) = 8F^{1/2}C^{1/4}$, the price of food is \$2/unit, the price of clothing is \$4/unit, and your income is \$972. How much of each do you buy? Find the marginal utility of \$1 of income.

3) (20 points) Answer EITHER Part A OR Part B.
A) Suppose the industry demand is given by $P = 101 - 2(Q_1+Q_2)$ and firm i's cost curve is given by $TC_i = 20 + Q_i + 2Q_i^2$. Find the two firms' Cournot outputs, price and profits.
B) Suppose you had already done the Cournot and found that the follower's best response function is given by $Q_F = 10 - \frac{1}{2}Q_L$. The price function is $P = 26 - \frac{1}{2}(Q_L + Q_F)$. The leader's total cost function is given by $TC_L = 5 + 8Q_L + (9/16)Q_L^2$. Find the profit maximizing output for the leader, the output for the follower, and the price. (Hint: If you are not doing a transformation, do not convert fractions to decimals. If you are transforming, transform the profit function as a whole, not the demand nor the TC.)

4) (22 points) Answer EITHER Part A OR Part B.
A) Suppose that your utility function is given by $U(C_0, C_1, C_2) = 16(C_0C_1C_2)^{1/4}$. Your income this year is \$200, next year is \$300, and in two years, you will be working part-time and expect to earn \$154. If the interest rate is 10%, then how much should you spend each period? What is the price of consumption this year?
B) Suppose your utility function for apples, bananas, and pears is given by $U(A,B,P)=8A^{1/4}B^{1/2}P^{1/8}$. The price of an apple is \$4/apple. The price of a banana is \$2/banana. The price of a pear is \$4/pear. It takes 2 minutes to skin an apple and 1 minute to peel a banana. However, pears are not peeled. If you have \$60 and can spend 24 minutes peeling fruit, then how many of each would you buy?

5) (26 points) Find the total cost, average total cost, and marginal cost function for a firm whose production function is given by $Q = 9K^{1/3}L^{1/2}$, capital costs \$4/K, and labor costs \$2/L. Do not worry about finding λ. If done correctly, you will get "9 to a power" and "3 to a power" part way through. It is probably easiest if you convert "9 to a power" to "3 to a different power" and keep the "3 to a power" as is. Everything will simplify easier that way.

Payoff Matrix		Sony		
		High price	Medium Price	Low Price
Yamaha	High Price	13 8	16 6	10 9
	Low Price	12 7	11 4	15 17